Specification:

Page 1, in the background section, the first paragraph, replace with the following new paragraph:

--- This invention is generally relative to multiband ultra wideband (UWB) communications ~~(UWB)~~ for short-distance wireless broadband communications.

Page 1, in the background section, the second paragraph, replace with the following new paragraph:

--- U.S. Federal Communications Commission (FCC) released the revision of Part 15 of the Commission's rules regarding UWB transmission systems to permit the marketing and operation of certain types of new products incorporating an UWB technology on April 22, 2002. With an appropriate technology, UWB devices [[can]] are able to operate using spectrum occupied by existing radio service without causing interference[[,]]. ~~thereby permitting scare~~ This allows scarce spectrum resources to be used more efficiently. The UWB technology offers significant benefits not only for Government[[,]] and public safety[[,]] but also for businesses and consumers under an unlicensed basis of operation spectrum.

Page 1, in the background section, the third paragraph (extends to page 2), replace with the following new paragraph:

--- In general, FCC is adapting unwanted emission limits for the UWB devices that are significantly more stringent than those imposed on other Part 15 devices. This is to say that FCC limits an outdoor use of UWB devices to handheld devices for the short-distance wireless broadband communications. For [[the]] an indoor operation of UWB communications, FCC provides a wide variety of the UWB devices, such as high-speed home and business networking devices under the Part 15 of the

Commission's rules subject to certain frequency and power limitations. ~~Limiting the frequency bands, which is based on the -10 dB bandwidth of the UWB emission, within certain UWB products will be permitted to operate.~~ In short, [[The]] the UWB devices must operate in the frequency band from 3.1 GHz to 10.6 GHz. In addition, the UWB ~~communication~~ devices should satisfy the Part 15.209 limit for the frequency band below 960 MHz and must meet the FCC's emission masks for the frequency band above 960 MHz.

Page 2, in the background section, the second paragraph, replace with the following new paragraph:

--- For the indoor operation of UWB communications, ~~operation,~~ Table 1 lists the FCC restrictions of the emission masks (dBm) along with the frequencies (GHz).

Table 1

Frequency (MHz)	EIRP (dBm)
0-960	-41.3
960-1610	-75.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

Page 2, in the background section, the third paragraph (extends to the page 3), replace with the following new paragraph:

--- [[The]] ~~outdoor~~ Outdoor handheld UWB ~~communication systems~~ devices are intended to operate in a peer-to-peer mode without restrictions on a location. ~~However,~~ [[the]] The outdoor handheld UWB devices ~~must operate in the frequency band from 3.1 GHz to 10.6 GHz, with an~~ have extremely conservative out of band emission masks to address interference

with other communication devices. ~~The outdoor handheld UWB communication devices are permitted to emit at or below the Part 15.209 limit in the frequency band below 960 MHz. The emissions above 960 MHz must conform to the following emission masks as shown in Table 2:~~ Table 2 shows UWB emission masks for outdoor operations:

Table 2

Frequency (MHz)	EIRP (dBm)
0-960	-41.3
960-1610	-75.3
1610-1900	-63.3
1900-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

Page 3, in the background section, the second paragraph (extends to the page 4), replace with the following new paragraph:

--- FCC defines an UWB device ~~as any device~~ where the fractional frequency bandwidth is greater than 0.25 based on the formula as follows[[,]]:

$$FB = 2\left(\frac{f_H - f_L}{f_H + f_L}\right), \qquad (1)$$

where f_H is the upper frequency of the –10 dB emission point and f_L is the lower frequency of the –10 dB emission point. The center frequency of [[the]] UWB transmission [[was]] is defined as the average of the upper and lower –10 dB points[[.]] ~~That is~~ as follows:

$$\cancel{F_C = \frac{f_H - f_L}{2}. \qquad (2)}$$

$$F_C = \frac{f_H + f_L}{2}. \qquad (2)$$

In addition, a minimum frequency bandwidth of 500 MHz must be used for indoor and outdoor UWB communication devices regardless of the center frequency.

Page 3, in the background section, the third paragraph (extends to the page 4), replace with the following new paragraph:

--- Thus, [[The]] the UWB communication devices must be designed to ensure that the indoor operations can only occur in an indoor environment according to the indoor emission masks as shown in Table 1. ~~or it must consist of hand-held devices that may be employed for such activities as peer-to-peer operation~~ The outdoor operations must be according to the outdoor emission masks in Table 2. [[Such]] The UWB communication devices ~~can be~~ are used for ~~wireless communications, particularly for~~ short-range high-speed data transmissions suitable for wireless broadband access to networks.

Page 4, in the background section, the second paragraph, replace with the following new paragraph:

--- The UWB communication devices, which are to be developed, [[is]] are [[true]] digital radio communications[[;]] ~~completely unlike the conventional radios we listen to and communicate every day. UWB communication device is~~ that belong to a wireless broadband communication[[s]] technology fundamentally. The UWB communication devices ~~is to~~ transmit a sequence of very short electrical pulses, billionths of a second long, which exist not only on any particular frequency but also on all frequencies simultaneously. The UWB communication devices [[uses]] employ modulated pulses with less one nanosecond in duration. The modulated pulses [[is]] can be ~~usually~~ assigned by a digital representation of ~~0 or 1~~ "0" or "1" according to the transmitted and received pulse based on where the pulses [[is]] are place in time. In other

words, ~~The key of~~ turning the ~~digital~~ modulated pulses [[into]] for the wireless broadband communications lies in the timing of the pulses. Therefore, [[In]] in order to [[hear]] recognize the information in ~~that code,~~ a digital pulse sequence, an UWB ~~radio~~ receiver has to know the exact pulse sequence used by [[the]] a transmitter.

Page 4, in the background section, the third paragraph (extends to the page 5), replace with the following new paragraph:

--- Each of the modulated pulses can exist simultaneously across an extensive frequency band ~~of frequencies~~ if the distributed energy of the modulated pulses at any given frequency exists in the noise floor. ~~Therefore,~~ Because of the above reason, the UWB devices can co-exist with other communication devices with no discernable interference. Therefore, [[This]] this opens vast new communications [[with]] providing tremendous wireless bandwidth to ease the growing bandwidth crunch.

Page 5, in the background section, the second paragraph, replace with the following new paragraph:

--- ~~However, with transmitting repeated ultra-short~~ Transmitting the modulated pulses ~~signals for the~~ with a very-high data rate [[in]] over the frequency ranges from 3.1 GHz to 10.6 GHz[[,]] requires an analog-to-digital (A/D) converter ~~should operate at~~ with a very-high sampling rate F_s ~~so that~~ in order to implement the UWB ~~communication~~ receiver ~~can implement~~ in a digital domain[[.]] directly. ~~In addition,~~ Furthermore, due to the FCC emission limitations [[for]] of the indoor and outdoor operations, [[the]] transmitting the modulated pulses [[must]] should be shaped [[so]] in such a way that the ~~transmitting~~ transmitted pulses [[do]] must not validate the FCC emission limitation. This leads to high requirements for designing a digital-to-analog (D/A) converter and a transmitter filter in [[the]] an UWB transmitter[[,]]. ~~thereby~~ However, it is

~~having a~~ difficult ~~problem~~ to design the A/D ~~converter~~ and [[the]] D/A converters with such a very ~~high-speed~~ high sampling rate for an UWB communication transceiver. ~~Moreover,~~ In addition, [[such]] the UWB communication transceiver [[is]] does not have a flexibility and scalability ~~for transmitting and receiving~~ to transmit and receive the modulated pulses if the UWB communication transceiver [[uses]] is designed to use the entire frequency band from 3.1 GHz to 10.6 GHz as one single-band operation.

Page 5, in the background section, the third paragraph (extends to the page 6), replace with the following new paragraph:

--- The present invention uses a multiband with a multicarrier solution to form 11 multichannels for the UWB communication transceiver. Each ~~channel~~ multichannel has a frequency bandwidth of 650 MHz, which allows transmitting [[the]] a data rate at 650 Msps. Shaped pulses that meet the FCC requirements of emission limitations for the indoor or outdoor operation can be transmitted on all of the multichannels at the same time. This ~~leads~~ is to say that the UWB communication transceiver is able to transmit a total of data rate up to 7.15 Gsps. As a result, ~~the transmitting data rate of~~ the UWB communication ~~device~~ transceiver can [[be]] transmit a data rate with flexibility ~~controlled with~~ and scalability. Moreover, the sampling ~~frequency~~ rate of the A/D and D/A converters can be reduced because of using [[the]] a multiband ~~solution~~ approach to substitute a single wideband[[.]] approach. In addition, ~~the single UWB communication device of~~ the present invention is a single device of the UWB communication transceiver, which can be used to deal with a dual-mode indoor and outdoor operation. This leads to saving cost for the UWB communication ~~device.~~ transceiver.

Page 6, in the background section, the second paragraph, replace with the following new paragraph:

--- Thus, there is a continuing need for ~~a multiband~~ the UWB communication transceiver [[with]] employing a new dual-mode shaped pulse[[s]] architecture ~~and polyphase-based~~ based on a ~~multichannel for~~ multiband and multicarrier [[radio]] solution for the indoor and outdoor operations.

Page 6, in the summary section, the third paragraph, replace with the following new paragraph:

--- In accordance with one aspect, a multiband UWB communication transmitter may include ~~a polyphase-based multichannel, a shaped pulse generator, and a N-switch in parallel to connect from the polyphase-based multichannel to the shaped pulse generator coupled to a multichannel-based multicarrier modulator.~~ an encoder coupled to an interleaver, the interleaver coupled to a polyphase-based multichannel, the polyphase-based multichannel coupled to a shaped pulse generator, the shaped pulse generator coupled to a multichannel-based multicarrier modulator, the multichannel-based multicarrier modulator coupled to a power amplifier (PA), a clock control coupled to the polyphase-based multichannel, the shaped pulse generator, and the multichannel-based multicarrier modulator.

Other aspects are set forth in the accompanying detailed description and claims.

Page 6, in the brief description of the drawings section, from the page 7 to the page 8, replace with the following new section:

--- FIG. 1 shows a block diagram ~~of one embodiment~~ of a multiband UWB communication transceiver for [[the]] indoor and outdoor operations[[.]] according to one embodiment.

--- FIG. 2 is a block diagram of ~~showing~~ a multiband UWB communication transmitter for the indoor and outdoor operations according to some embodiments.

--- FIG. 3 is a detailed block diagram of a ~~polyphhase-based~~ polyphase-based multichannel and multicarrier of the UWB communication transmitter according to some embodiments.

--- FIG. 4 is a [[BPSK]] binary phase-shift keying (BPSK) modulation relationship between [[the]] a shaped pulse sequence and [[the]] a binary symbol sequence according to some embodiments.

--- FIG. 5 is a two-block diagram of ~~showing~~ a polyphase-based serial-to-parallel (S/P) multichannel according to some embodiments.

--- FIG. 6 is a [[QPSK]] quadrature phase-shift keying (QPSK) modulation relationship between the shaped pulse sequence and the binary symbol sequence according to some embodiments.

--- FIG. 7 is shaped digital pulses for [[the]] an indoor UWB communication transmitter according to some embodiments.

--- FIG. 8 is a frequency spectrum of the shaped digital pulses for the indoor UWB communication transmitter according to some embodiments.

--- FIG. 9 is the shaped digital pulses for [[the]] an outdoor UWB communication transmitter according to some embodiments.

--- FIG. 10 is a frequency response of the shaped digital pulses for the outdoor UWB communication transmitter according to one embodiment.

--- FIG. 11 is a block diagram of ~~showing~~ two pulse memory banks according to some embodiments.

--- FIG. 12 is a frequency response of a multiband solution for the indoor UWB communication transmitter according to one embodiment.

--- FIG. 13 is a frequency response of [[a]] the multiband solution for the outdoor UWB communication transmitter according to one embodiment.

--- FIG. 14 is a block diagram of [[the]] a multiband UWB receiver for the indoor and outdoor operation according to some embodiments.

--- FIG. 15 is a detailed block diagram of a polyphase-based multichannel and multicarrier down converter for ~~a de-multiband solution~~ the multiband UWB receiver according to one embodiment.

--- FIG. 16 is a detailed block diagram of ~~showing~~ a polyphase-based parallel-to-serial (P/S) according one embodiment.

Page 8, in the detailed description section, the last paragraph (extends to the page 9), replace with the following new paragraph:

--- Some embodiments described herein are directed to [[the]] a multiband UWB communication transceiver for the indoor and outdoor operations. The multiband UWB communication transceiver may be implemented in hardware, such as in an Application Specific Integrated Circuits (ASIC), digital signal processor, field programmable gate array (FPGA), software, [[or]] and/or a combination of hardware and software.

Page 9, in the detailed description section, the second paragraph (extends to the page 10), replace with the following new paragraph:

--- A multiband UWB communication transceiver 100 for the indoor and outdoor operations is illustrated in FIG. 1 in accordance with one embodiment of the present invention. The multiband UWB communication transceiver 100 includes a low noise amplifier (LNA) and power amplifier (PA) section 114 that receives and transmits multiband UWB signals from an antenna 112 and to an antenna 110. The LNA and PA section 114 is coupled to a UWB multichannel-based multicarrier RF section 116. The UWB multichannel-based multicarrier RF section 116 is connected [[with]] to an analog and digital interface section of 118 that contains analog-to-digital (A/D) and digital-to-analog (D/A) converters. The analog and digital interface section 118 is coupled to an digital baseband processing section 120, which performs polyphase multichannel digital transmission and receiver filtering, rake processing, shaped pulse

generation, interleave/de-interleave, and code/de-code processing. The digital baseband processing section 120 has an interface with an UWB network interface section 122, [[in]] which is coupled to an UWB network 124. In accordance with one embodiment of the present invention, the multiband UWB communication transceiver 100 is ~~so-called~~ used ~~multiband UWB communication transceiver~~ for the indoor and outdoor operations. [[that]] The multiband UWB communication transceiver 100 can [[both]] transmit and receive speech, audio, images and video, and data information for [[the]] indoor and outdoor wireless broadband communications.

Page 10, in the detailed description section, the second paragraph, replace with the following new paragraph:

--- The multiband UWB communication transceiver 100 [[can]] has a flexibility to transmit and receive [[the]] UWB signals by using one channel and/or up to 11 channels in parallel. Each channel of the UWB communication transceiver 100 has a frequency bandwidth of 650 MHz that can transmit a data rate of 650 Msps. As a result, the UWB communication transceiver 100 [[can]] is able to transmit and receive the data rate up to 7.150 Gsps by using all of the channels in parallel.

Page 10, in the detailed description section, the third paragraph (extends to the page 11), replace with the following new paragraph:

--- FIG. 2 is the block diagram of ~~showing~~ a multiband UWB communication transmitter 200 for the indoor and outdoor operations according to some embodiments. The multiband UWB communication transmitter 200 receives user data bits 210 ~~with information~~ at a data rate [[at]] of 3,575 Mbps. The ~~information~~ user data bits 210 are passed through a 1/2-rate convolution encoder 212 that may produce [[the]] a double data rate of 7,150 Msps by adding redundancy bits. [[The]] A

symbol data, which is an output sequence of the ½-rate convolution encoder 212, is then interleaved by using an interleaver 214. Thus, the output symbols of the interleaver 214 are formed into 11-multichannel by using a polyphase-based multichannel 216. [[The]] A symbol data rate of each channel is 650 Msps. The polyphase-based multichannel 216 is to perform a serial data into a parallel data by using [[the]] a polyphase operation. The polyphase-based multichannel 216 is coupled to a shaped pulse generator 218 that generates the shaped digital pulses for the polyphase-based multichannel 216 based on [[the]] an individual symbol. Each of the shaped digital pulses has a frequency bandwidth of 650 MHz at -10 dBm and -20 dBm for the indoor and outdoor operations, respectively. The output shaped digital pulses of the polyphase-based multichannel 216 are then modulated with multi-carrier frequencies by using a multichannel-based multi-carrier modulator 220. [[The]] A clock control 222 is used to control the polyphase-based multichannel 216, the shaped pulse generator 218, and the multichannel-based multicarrier[[e]] modulator 220. Thus, the output shaped digital pulses of the multichannel-based multi-carrier modulator 220 are passed a power amplifier (PA) 224 through an antenna into air. The entire subsystem section 226 is referred to as [[the]] a polyphase multichannel-based multicarrier pulse generator.

Page 11, in the detailed description section, the second paragraph (extends to the page 12), replace with the following new paragraph:

--- Referring to FIG. 3 is a detail block diagram of the polyphase multichannel-based multicarrier pulse generator 226 according to some embodiments. [[The]] An input signal is assumed as x[n], where x[n] is an either "1" or "0" sequence for a serial-to-parallel (S/P) unit 310, which is a polyphase structure [[of]] downsampling by 11. The output of ~~the serial-to-parallel~~ the S/P unit 310 contains 11 channels ~~with labels~~ labeled from 311a to 311k in a parallel operation. Correspondingly, the output signals

of the ~~serial-to-parallel~~ S/P unit 310 are x[11n], x[11n-1], ..., x[11n-9] and x[11n-10], which are as the input signals for a set of parallel multichannel switch units 320a, 320b, ..., 320j, 320k, respectively. A software control unit 390 determines whether a symbol is 1 or 0 for all of the channels 311a – 311k. For example, channel 331a, if the signal x[11n] is "1", and then a switch 360a is connected [[with]] to a position 330a. Thus, a positive pulse bank 314 that contained an positive indoor shaped digital pulse or an positive outdoor shaped digital pulse is coupled to a D/A converter 318 to generate an analog shaped pulse $y_a(t)$ for the channel 331a. The analog shaped pulse $y_a(t)$ is then multiplied by a carrier function of $\cos(2\pi f_1 t)$ 370a to produce the first bandpass signal for the channel 331a. Otherwise, the switch 360a is connected [[with]] to a position 330b if the signal x[n] is "0" symbol. A negative pulse bank 312, which [[that]] contained a negative indoor shaped digital pulse or a negative outdoor shaped digital pulse, is coupled to a D/A converter 316 to generate an analog shaped pulse $y_a(t)$ for the channel 331a. Then, the analog shaped pulse $y_a(t)$ is multiplied by the carrier function of $\cos(2\pi f_1 t)$ 370a to produce the first bandpass signal for the channel 331a. In a similar way, the polyphase multichannel-based multicarrier pulse generator 226 generates [[the]] analog shaped pulses $y_a(t)$, ..., $y_k(t)$ for all of the channels 311a to 311k. Thus, the entire analog shaped pulses $y_a(t)$, ..., $y_k(t)$ are coherently added together to pass a PA 224 through an antenna into air.

Page 13, in the detailed description section, the first paragraph, replace with the following new paragraph:

--- Referring to FIG. 4 is a relationship 400 between a shaped digital pulse sequence and a binary symbol sequence based on a BPSK modulation for the multiband UWB communication transmitter according to some embodiments. A shaped digital pulse 410 represents "1" binary symbol while a shaped digital pulse 420 represents "0" binary symbol. The shaped

digital pulse 410 is referred to as a "positive" pulse and the shaped digital pulse 420 is referred to as a "negative" pulse. [[The]] A self-correlation of the shaped digital pulse 410 and 420 has a positive [[vale]] value close to "1". On the other hand, [[the]] a cross-correlation between the shaped digital pulse[[s]] 410 and the shaped digital pulse 420 has a negative [[vale]] value close to "-1".

Page 13, in the detailed description section, the second paragraph (extends to the page 14), replace with the following new paragraph:

--- FIG. 5 is a detailed block diagram 500 of ~~showing the~~ a polyphase-based ~~serial-to-parallel~~ S/P multichannel based on a QPSK modulation for the indoor or outdoor [[UWB]] operations according to some embodiments. In the detailed block diagram 550, an input sequence x[n] with either 1 or 0 symbol sequence passes through the ~~serial-to-parallel~~ S/P unit 310 to generate 11 channel sequences 510a-510k. Determining each channel of the sequences 510a –510k is based on the formula: {x[11n-1], x[11n]}; {x[11n-3], x[11n-2]}; {x[11n-5], x[11n-4]}; {x[11n-7], x[11n-6]}; {x[11n-9], x[11n-8]}; {x[11n-11], x[11n-10]}; {x[11n-13], x[11n-12]}; {x[11n-15], x[11n-14]}; {x[11n-17], x[11n-16]}; {x[11n-19], x[11n-18]}; and {x[11n-21], x[11n-20]}, for n = 0, 2, 4, 6, ..., respectively. On the other hand, using an alternative approach as shown in a block diagram 560 can also [[do]] perform [[this]] the polyphase-based ~~serial-to-parallel~~ S/P multichannel to achieve the same output as the block diagram 550 does. A switch 530 rotates connecting [[with]] to one of the eleven positions 540a-540k at uniform speed. For example, the switch 530 is connected to the position 540a for the first channel when n = -1, 0, 21, 22, ... The switch 530 is connected to the position 540b for the second channel when n = -3, -2, 19, 20, ..., and so on. During the process, the switch 530 is controlled ~~from the~~ by a software control unit 390.

Page 14, in the detailed description section, the second paragraph, replace with the following new paragraph:

--- FIG. 6 is a QPSK relationship 600 between the shaped digital pulse sequences and the binary symbol sequences based on every two symbols. A positive shaped digital pulse 610a represents two symbols "00". The positive shaped digital pulse 610b, with a delay time Δ, represents two symbols "01". A negative shaped digital pulse 620a represents two symbols "11". The negative shaped digital pulse 620b[[,]] [[with]] having the delay time Δ[[,]] represents two symbols "10". This expression ~~leads to using~~ uses one shaped digital pulse to ~~substitute~~ represent two symbols for transmitting. ~~a pulse sequence on each channel of the multiband UWB communication transmitter.~~

Page 14, in the detailed description section, the third paragraph (extends to the page 15), replace with the following new paragraph:

--- Referring to FIG. 7 is impulse responses 700 of the positive indoor shaped digital pulse ($h_{in}[n]$) 710 and the negative indoor shaped digital pulse ($-h_{in}[n]$) 720, with a linear phase. ~~The different~~ A difference between the positive indoor shaped digital pulse 710 and the negative indoor shaped digital pulse 720 is a phase difference. These two shaped digital pulses 710 and 720 are stored into the pulse banks 312 and 314, where are ROM or RAM memory banks. The ~~discrete-time~~ impulse response of the positive indoor shaped digital pulse 710 is listed in Table 3.

Table 3

Pulse taps	Value	Pulse taps	Value
h[0]	8.4011931856093516e-005	h[-20],h[20]	-1.3294520798670319e-006
h[-1],h[1]	6.6460293297797776e-005	h[-21],h[21]	1.5173609022831139e-007
h[-2],h[2]	3.4899656505824461e-005	h[-22],h[22]	1.0025701140610793e-006
h[-3],h[3]	4.3116710798781203e-006	h[-23],h[23]	8.8427894743416094e-007
h[-4],h[4]	-1.1214285545543695e-005	h[-24],h[24]	3.2126248293514667e-007
h[-5],h[5]	-1.1091966005094216e-005	h[-25],h[25]	-1.6257131448705735e-007

h[-6],h[6]	-4.0631985867674594e-006	h[-26],h[26]	-4.2373069355925035e-007
h[-7],h[7]	1.6925543297452028e-006	h[-27],h[27]	-4.9081265774967211e-007
h[-8],h[8]	3.7995683513152043e-006	h[-28],h[28]	-3.2008852157750218e-007
h[-9],h[9]	3.5715207002110990e-006	h[-29],h[29]	7.1976640681523624e-008
h[-10],h[10]	2.1069446071156423e-006	h[-30],h[30]	4.4865425611366231e-007
h[-11],h[11]	-3.6643652826194515e-007	h[-31],h[31]	4.8145760999611724e-007
h[-12],h[12]	-2.8164861523475095e-006	h[-32],h[32]	1.1716686662078990e-007
h[-13],h[13]	-3.3131485713709617e-006	h[-33],h[33]	-3.2175597663148811e-007
h[-14],h[14]	-1.1423931641665744e-006	h[-34],h[34]	-4.3124038368895124e-007
h[-15],h[15]	1.8766255546648780e-006	h[-35],h[35]	-1.5028657655143136e-007
h[-16],h[16]	3.0434874609545600e-006	h[-36],h[36]	2.0356981673707622e-007
h[-17],h[17]	1.5335471709233686e-006	h[-37],h[37]	2.8036698051837603e-007
h[-18],h[18]	-9.2517743205833720e-007	h[-38],h[38]	7.1364948530875849e-008
h[-19],h[19]	-2.0795608829123639e-006	h[-39],h[39]	-1.4582779654249872e-007

Page 16, in the detailed description section, the first paragraph, replace with the following new paragraph:

--- Referring to FIG. 8 is a frequency response 800 of the positive and negative indoor shaped digital pulses 710 and 720, respectively, according to some embodiments. The frequency response 800 is symmetric at the center frequency <u>and is used</u> for ~~the use in the~~ indoor UWB operation<u>s</u>.

Page 16, in the detailed description section, the second paragraph (extends to the page 17), replace with the following new paragraph:

--- Now referring to FIG. 9 are impulse responses 900 of the positive outdoor shaped digital pulse ($h_{out}[n]$) 910 and the negative outdoor shaped digital pulse ($-h_{out}[n]$) 920, with a linear phase. ~~The different~~ <u>A difference</u> between the outdoor shaped digital pulse 910 and 920 is a 180-degree in phase. These two shaped digital pulses 910 and 920 are stored into the pulse banks 312 and 314, where are ROM or RAM memory banks. The ~~discrete-time~~ impulse response of the positive outdoor shaped digital pulse 910 is listed in Table 4.

Table 4

Pulse Taps	Value	Coefficients	Pulse Taps
h[0]	7.6488735705936605e-005	h[-21],h[21]	-9.9696474129624093e-007
h[-1],h[1]	6.2636205884599369e-005	h[-22],h[22]	6.8001098631267257e-007
h[-2],h[2]	3.8360738472336015e-005	h[-23],h[23]	1.6055470083229580e-006
h[-3],h[3]	1.1315222826039952e-005	h[-24],h[24]	1.3544197859980424e-006
h[-4],h[4]	-7.5438087863256088e-006	h[-25],h[25]	2.8906713844065611e-007
h[-5],h[5]	-1.3715350107903802e-005	h[-26],h[26]	-7.7640460252440758e-007
h[-6],h[6]	-9.6549464333329795e-006	h[-27],h[27]	-1.1590268443143087e-006
h[-7],h[7]	-1.4025569435129311e-006	h[-28],h[28]	-7.2082016980864959e-007
h[-8],h[8]	5.3003810907673923e-006	h[-29],h[29]	1.0449113646872343e-007
h[-9],h[9]	7.2459334117828691e-006	h[-30],h[30]	7.0581527869524552e-007
h[-10],h[10]	4.3825454945279616e-006	h[-31],h[31]	7.2894825863413297e-007
h[-11],h[11]	-7.3762240948801741e-007	h[-32],h[32]	2.7772069871654161e-007
h[-12],h[12]	-4.5458747488001017e-006	h[-33],h[33]	-2.5824128353050490e-007
h[-13],h[13]	-4.7131566336279298e-006	h[-34],h[34]	-5.0913724964550914e-007
h[-14],h[14]	-1.6403017957724223e-006	h[-35],h[35]	-3.7669532172385286e-007
h[-15],h[15]	2.0411082705529443e-006	h[-36],h[36]	-3.2564239303970273e-008
h[-16],h[16]	3.6642171169389545e-006	h[-37],h[37]	2.4370835675220430e-007
h[-17],h[17]	2.4832733363889074e-006	h[-38],h[38]	2.9201867311458947e-007
h[-18],h[18]	-1.2626402560439206e-007	h[-39],h[39]	1.4137476178313894e-007
h[-19],h[19]	-2.1121354877069656e-006	h[-40],h[40]	-5.5504489846808052e-008
h[-20],h[20]	-2.3106300667210457e-006	h[-41],h[41]	-1.7766983155229356e-007

Page 17, in the detailed description section, the second paragraph, replace with the following new paragraph:

--- Referring to FIG. 10 is a frequency response 1000 of the outdoor shaped digital pulses 1010 and 1020 according to some embodiments. The frequency response 1010 is also symmetric about the center frequency and is used for ~~the use in the~~ outdoor UWB operations.

Page 17, in the detailed description section, the third paragraph (extends to the page 18), replace with the following new paragraph:

--- Referring to FIG. 11 is a detailed block diagram 1100 of ~~showing two memory banks~~ the negative pulse bank 312 and the positive pulse bank 314 according to some embodiments. The memory banks of 1120, 1122, 1170 and 1172 are RAMs or ROMs for storing the indoor shaped digital pulses 710 and 720, and the outdoor shaped digital pulses 910 and 920. ~~for the indoor or outdoor UWB operation.~~ The memory bank 1120 contains the positive indoor shaped digital pulse 710 while the memory bank 1170 includes the negative indoor shaped digital pulse 720. The memory bank 1122 consists of the positive outdoor shaped digital pulse 910 while the memory bank 1172 has the negative outdoor shaped digital pulse 920. The memory banks 1120 and 1122 are referred to as positive memory banks, and the memory banks 1170 and 1172 are called negative memory banks. There are two switch units 1124 and 1174. The switch 1124 is called a positive pulse switch unit and the switch 1174 is referred to as a negative pulse switch unit. ~~The switches~~ Switches 1124 and 1174 are controlled by using a software control 390. ~~determining~~ The software control 390 can determine which one of positions should be connected to generate the shaped digital pulses for the BPSK or QPSK modulation ~~based on~~ during the indoor or outdoor UWB operations. ~~by using the software control 390.~~

Page 18, in the detailed description section, the second paragraph, replace with the following new paragraph:

--- FIG. 12 is an output frequency spectrum 1200 of the polyphase multichannel-based multicarrier pulse generator for the indoor UWB operation, including 11 transmitter channel spectrums 1220A-1220K according to some embodiments. An indoor FCC emission limitation 1210 is also shown in FIG. 12. Each channel has a frequency bandwidth [[is]] of 650 MHz. [[and]] As can be seen, all of the channels [[is]] are fitted under

the indoor FCC emission limitation 1210 with different carrier frequencies. The detail positions of each transmitter channel spectrum[[s]] (dBm) along with the center, lower and upper frequencies (GHz) as well as channel frequency bandwidth (MHz) are listed in Table 5.

Table 5

Multichannel Label	Center Frequency (GHz)	Lower Frequency (GHz)	Upper Frequency (GHz)	Frequency Bandwidth (MHz)
1220A	3.45	3.125	3.775	650
1220B	4.10	3.775	4.425	650
1220C	4.75	4.425	5.075	650
1220D	5.40	5.075	5.725	650
1220E	6.05	5.725	6.375	650
1220F	6.70	6.375	7.025	650
1220G	7.35	7.025	7.675	650
1220H	8.00	7.675	8.325	650
1220I	8.65	8.325	8.975	650
1220J	9.30	8.975	9.625	650
1220K	9.95	9.625	10.275	650

Page 19, in the detailed description section, the first paragraph, replace with the following new paragraph:

--- FIG. 13 is an output frequency spectrum 1300 of the polyphase multichannel-based multicarrier pulse generator for the outdoor UWB operation, including 11 transmitter channel spectrums 1320A-1320K along with the outdoor FCC emission limitation 1310 according to some embodiments. Each channel also has a frequency bandwidth [[is]] of 650 MHz. ~~and is~~ It is also clear that all of the channels at different carrier frequencies are fitted under the outdoor FCC emission limitation 1310. ~~with different carrier frequencies.~~

Page 19, in the detailed description section, the second paragraph (extends to the page 20), replace with the following new paragraph:

--- FIG. 14 is a block diagram of [[the]] a multiband UWB communication receiver 1400 for the indoor and outdoor operations according to some embodiments. A low noise amplifier (LNA) 1410, which is coupled to an automatic gain control (AGC) 1420, receives the UWB signals from an antenna. The output of LNA 1410 is passed through the AGC 1420 to adjust amplitude of the UWB signals for a multichannel-based multicarrier down converter 1430. [[The]] A software and time control 1440 is use to control the AGC 1420 and the multichannel-based multicarrier down converter 1430. The bandlimited UWB analog signals of the output multichannel-based multicarrier down converter 1430 are then sampled and quantized by using an A/D converter 1432[[,]] [[with]] [[the]] at a sampling ~~frequency~~ rate of 720 MHz. The output digital signals of ~~the output of~~ the A/D converter 1432 are filtered by using an indoor or outdoor digital receiver lowpass filter 1434 to remove the out of band signals. ~~with controlling from the~~ The indoor or outdoor digital receiver lowpass filter 1434 is controlled by a software and time control 1440. The output data [[from]] of the digital receiver lowpass filter 1434 is used for a rake receiver 1436. [[The]] A channel estimator 1442 is used to estimate a channel phase and frequency. The channel phase and frequency information [[that]] are then passed into the rake receiver 1436. The rake receiver 1436 calculates a correlation between the received UWB pulse signals and template pulses, which are provided by using a template pulse generator 1450, and performs a coherent combination. The output of the rake receiver 1436 is passed to an equalizer 1444, which also receives the channel phase and frequency information from the channel estimator 1442, to eliminate inter-symbol interference (ISI), inter-channel interference (ICI), and inter-pulse interference (IPI). Then, the output symbol data of the equalizer 1444 ~~passes~~ is passed to a de-interleaver 1446. Thus, the

symbol data is de-interleaved by using the de-interleaver 1446. The output symbol data of the de-interleaver 1446 is used for [[the]] Viterbi decoder 1448 to decode the encoded data and to produce the ~~information~~ user data bits at 3,575 Mbps. The entire section unit 1460 is referred to as a polyphase multichannel combiner of the multicarrier down converter.

Page 20, in the detailed description section, the second paragraph (extends to the page 21), replace with the following new paragraph:

--- Referring to FIG. 15[[,]] ~~which~~ is a detailed block diagram 1500 of ~~showing one embodiment of~~ the polyphase multichannel combiner of the multicarrier down converter 1460 [[of]] according to the present invention. The received signals r(t) are formed 11 channel signals ~~with labels of~~ labeled with 1502a-1502k, [[with]] which are multiplied by carrier frequency functions of $\cos(2\pi f_1 t), \ldots, \cos(2\pi f_{11} t)$, to produce the output signals $r_1(t), \ldots, r_{11}(t)$, respectively. In a parallel form, [[then]] all of the signals $r_1(t), \ldots, r_{11}(t)$ are then passed to a set of parallel anti-aliasing analog filters 1520a-1520k, which produce ~~to have~~ the bandlimited signals for a set of parallel A/D converters 1530a-1530k [[and]] followed by digital receiver lowpass filters 1540a-1540k. Then, the output signals of the digital receiver filters 1540a-1540k are used for a set of rake receivers 1550a-1550k to perform [[the]] correlation measures between the [[input]] received pulses and the template pulses, which are ~~provided~~ generated from [[by]] the template pulse generator 1450. Thus, the output channel signals r[11n+10], ..., rs[11n] of the rake receiver 1550a-1550k are combined by using a polyphase upsampling structure to generate the output sequence.

Page 21, in the detailed description section, the second paragraph, replace with the following new paragraph:

--- Referring to FIG. 16 is a detailed block diagram 1600 of ~~showing one embodiment of~~ a polyphase-based parallel-to-serial <u>(P/S)</u> 1560 <u>according to one embodiment</u>. The input <u>sequence,</u> including 11 channels 1620a-1620k in parallel, has a length of symbol M. A switch 1630 rotates from a position 1620k to a position 1620a with a uniform speed [[of]] <u>at</u> every two symbols to produce an output ~~serial~~ sequence with a symbol length of 11M. [[The]] <u>A</u> software and time control 1440 controls the switch 1630 during the operation. The <u>speed of the</u> switch 1630 is adjustable [[for]] <u>at</u> a uniform speed [[at]] <u>for</u> a different number of symbols.

Page 21, in the detailed description section, the last paragraph (extends to the page 22), replace with the following new paragraph:

--- While the present invention[[s]] [[have]] <u>has</u> been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of the[[se]] present invention[[s]].

What is claimed is: